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Group Report

1964-45

H. E. Frachtman

Haystack Pointing System: Moon

10 September 1964

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MASSACHUSETTS INSTITUTE OF TECHNOLOGY
LINCOLN LABORATORY

HAYSTACK POINTING SYSTEM: MOON

H. E. FRACHTMAN

Group 62

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ABSTRACT

This report describes the procedure used by the Haystack pointing computer program for obtaining the celestial coordinates of the Moon at any time.

Accepted for the Air Force
Franklin C. Hudson, Deputy Chief
Air Force Lincoln Laboratory Office

I. INTRODUCTION

MOONTRACK is a program in the Haystack Univac 490 pointing system whose output is the celestial coordinates of the Moon at a given time. The program computes the coordinates by 4th difference interpolation in the tables of the apparent right ascension, declination, and radius vector of the Moon published in The American Ephemeris. The rates of change of the three quantities are computed by numerical differentiation.

II. INPUTS TO PROGRAM

A. Inputs Furnished by Core Memory

The program uses the registers listed in Table I for input information. The year and day are used to select the appropriate entries from the ephemeris. The coordinates of the Moon are interpolated for the time which is the sum of the times in CELTIME and DELTATEE.

B. Inputs Furnished by Magnetic Tape

The tape format of the Moon Ephemeris, which has been edited and recorded on tape by a 7094 program described in Reference (1), is shown in Fig. 1. Each block of 192 words covers a period of one day. The ephemeris for each day required 8 words for each of 24 hours. The program does not make use of the hour-year-month-day words in the block. The tape must be on Unit 1 (normally Servo B) of the Univac 490.

III. PROGRAM OUTPUTS

A. Outputs Left in Core Memory

The apparent celestial coordinates of the Moon, corresponding to the time in the register CELTIME, together with their numerical derivatives, are stored in the appropriate registers, as illustrated in Table II.

<u>Register</u>	<u>Contents and Scaling</u>
W(CELTIME)	Days B28
W(DELTATEE)	Days B28
U(YEARMONTH)	Year B15 (4 decimal digits)
L(YEARMONTH)	Month B0
L(DAY)	Day of Year B0
W(EQUATOR)	Equatorial radius of Earth B17

TABLE I
Core Memory Inputs to MOONTRACK Program

NOTE: Notation "B28" means
that the binary point is to the
right of bit 28.

3-62-3003

I. D.	13 _d	Conventional Day Number	14	0
All Zero	Hour	Year	Month	Day
Right Ascension		B26	Radians	
First Difference Right Ascension		B26	Radians	
Declination		B26	Radians	
First Difference Declination		B26	Radians	
Radius Vector		B22	Earth Equatorial Radii	
First Difference Radius Vector		B22	Earth Equatorial Radii	

Fig. 1. Magnetic Tape Format for Moon Ephemeris

<u>Register</u>	<u>Contents and Scaling</u>
W(RA)	Apparent Right Ascension B27 in revolutions
W(DEC)	Apparent Declination B27 in revolutions
W(RADIUS)	Distance from center of Earth to center of Moon, B22 Earth Equatorial radii
W(RADOT)	Numerical Derivative of Right Ascension B37 radians/sec
W(DECDOT)	Numerical Derivative of Declination B37 radians/sec
W(RADIUSDOT)	Numerical Derivative of Radius Vector B24 nautical miles/sec

TABLE II
Core Memory Outputs of MOONTRACK Program

B. Typewriter Outputs

During initialization the MOONTRACK program will type, using the INTERCOM subroutine, certain information concerning the Moon. Items printed are:

1. Julian Day corresponding to values in YEARMONTH, DAY, and CELTIME (7 digits).
2. Apparent Right Ascension of the Moon (Hours, Minutes, Seconds to hundredths).
3. Apparent Declination of the Moon (Degrees, Minutes, Seconds to hundredths).
4. Day of Year corresponding to values in YEARMONTH and DAY (up to 3 digits).
5. Universal Time for which the coordinates are interpolated. It is the time in CELTIME at initialization (Hours, Minutes, Seconds to hundredths).
6. The distance between the centers of the Earth and the Moon (Earth's Equatorial radii to millionths).
7. The words "OBJECT MOON".

If, after a search through 12 files on Unit 1 (or the finding of an end of tape mark), the moon ephemerides are not found, the program will type "MOON EPHEMERIS FOR X/Y NOT AMONG FIRST 12 FILES" and will exit to the master control program error return. "X" and "Y" indicate the current month and year, respectively.

If there is a tape servo malfunction during search, the program will type "IIIC STATUS S1 ZZ" and will exit to the master control program error return. The two digit octal number "ZZ" comes from the tape status word and indicates the error condition.

IV. ASTRONOMICAL SIGNIFICANCE

The apparent right ascension and declination of the Moon in the ephemerides are referred to the true equinox and equator of date and are corrected for planetary aberration. They are geocentric apparent quantities; the parallax correction is made by the coordinate conversion program (COCON) in the Haystack system. The values in the tables are computed for Ephemeris Time as argument. The equation

$$ET = UT + \Delta T$$

is used to convert from Universal Time to Ephemeris Time. The constant ΔT , represented by the number in the register DELTATEE is approximately 35 seconds.

The values for the radius vector and first difference of the radius vector which appear on the ephemeris tape (Figure 1) are computed from the Moon's horizontal parallax which occurs in the source data. The formula

$$D = \frac{1}{\sin h}$$

is used by the tape preparation program (Reference 1) to compute the distance D, in units of Earth's equatorial radii, from the geocentric equatorial horizontal parallax h. The register EQUATOR contains a number which represents the Earth's equatorial radius in nautical miles.

V. PROGRAM DETAILS

The MOONTRACK program is a subroutine of the Haystack Univac 490 pointing program. The initialization section begins at MOONINIT, the working section at MOONCONT. There are several closed subroutines within MOONTRACK. These are: DAYFIND, STATUSCK, INTERPOL, LEFRNDOFF, and MOONTIME. A listing of the program is given in Appendix I.

A. Initialization

The program, upon initialization, stores an RIL instruction in the tape channel internal interrupt register and an RJP STATUSCK instruction in the external interrupt register. The area in core into which the tape data will be read is cleared, together with some additional registers. This is done to make diagnosis easier in case of malfunction.

The daily Moon ephemeris entries are serially numbered by the program which generates the magnetic tape (Reference 1). These serial numbers are called "Conventional Day Numbers" (CDN). An arbitrary decision was made to produce and use tapes such that the CDN for 25 April 1963 is zero. The tape search process looks at the first word in each block, therefore, the MOONTRACK, program must compute the CDN of the block containing the entry for the required hour.

Using as inputs the year, day of year, and the effect of integral and half-integral values of CELTIME, the program computes the Julian Day number for the typewriter. The ephemerides start and run continuously from 25 April 1963, which has a Julian Day Number of 2438144.5; this number is subtracted from the computed Julian Day number and appears on tape as the Conventional Day Number. The first CDN in a block is stored in SAFE and TAPEBLOCK and the Moon identification number is added to generate a tape search comparison word.

Six blocks of Moon ephemerides are read to provide sufficient data for 4th difference Bessel interpolation for a four day period.

If the six block search and read operations are successful control is regained at NORMAL and the tape is rewound without interrupt or interlock.

The MOONTIME subroutine is entered to select and store the addresses of the ephemeris entries corresponding to the hour of the day and to compute the interpolation argument P. The register TIME2 contains a number representing the integral number of hours in the sum of CELTIME and DELTATEE.

Besselian interpolation of right ascension is done by the INTERPOL subroutine and the interpolated result is converted to hours, minutes, and seconds and stored for type out. Declination and distance are then interpolated and stored for type out. The other quantities which are to be typed out by INTERCOM are set up. Control is transferred to INTERCOM 7 times for the seven line type out, which completes operation of the initialization section of MOONTRACK.

B. Working Section

The MOONTRACK working section begins at MOONCONT. Control is transferred to the subroutine MOONTIME which selects the ephemeris entry corresponding to the current hour, stores the addresses of the table entries, and computes the interpolation argument P from the given value of CELTIME. The INTERPOL subroutine is then entered three times for the interpolation of right ascension, declination, radius and their time rates. All values are converted, scaled and stored properly in core memory and control is transferred to the master control program.

C. Subroutines

The initialization section of the MOONTRACK program makes use of the INTERPOL, DAYFIND, STATUSCK, LEFRNDOFF, and MOONTIME subroutines. The working section uses all except STATUSCK.

1. INTERPOL

The MOONTRACK interpolation subroutine uses Bessel's interpolation formula for (Reference 3) 4th difference interpolation of the Moon's ephemeris. The formula is

$$f_p = f_0 + P\delta f_{1/2} + \frac{P(P-1)}{4} [\delta^2 f_0 + \delta^2 f_1] \\ + \frac{P(P-1)(P-1/2)}{6} \delta^3 f_{1/2} + \frac{(P+1)P(P-1)(P-2)}{48} (\delta^4 f_0 + \delta^4 f_1)$$

The quantities in the formula are associated with computer registers as follows:

- a. The address of f_0 is in index register 4.
- b. The interpolation argument P is in register P .
- c. $\delta f_{1/2}$ is in register GAMMA.
- d. $P(P-1)$ is in register PSQMP.
- e. $\delta^2 f_0 + \delta^2 f_1$ is in register DMINB.
- f. $\frac{P(P-1)}{6}$ is in register PSQMP6.
- g. $\delta^3 f_{1/2}$ is in register DMIN2CPLB.
- h. $(\delta^4 f_0 + \delta^4 f_1)$ is in register EP2BM2DMA.
- i. f_P is in the A register at the finish.

The subroutine also performs numerical differentiation using the following formula (Reference 3):

$$hf' P = \delta f_{1/2} + \frac{2P-1}{4} [\delta^2 f_0 + \delta^2 f_1] \\ + \frac{3P^2 - 3P + 1/2}{6} \delta^3 f_{1/2}$$

At the completion of the subroutine, $hf' P$ is stored in the register NUMDERIV.

When the subroutine is entered, Index Register 4 contains the address of f_0 and the register SETINTAD contains the address of $\delta f_{1/2}$ of the quantity to be interpolated. Index register 3 is used to acquire the other two first difference registers.

2. DAYFIND

The DAYFIND subroutine computes the Julian Day number and CDN corresponding to the current day.

3. STATUSCK

The STATUSCK subroutine is entered from the external interrupt register associated with the tape channel when the interrupt occurs. Examination of the status code generates four possible outcomes:

- a. If the code indicates a normal completion, control is returned to the program at the interrupted point.
- b. If the code indicates that an end of tape mark was sensed, the tape is rewound and a message indicating failure to find the ephemeris is printed by the typewriter. The message is described in Section III B. Control is passed to the error return of the master control program.
- c. If the code indicates that an end of file mark was sensed, the register IMPERIAL is indexed and tested for the value 12. When less than 12 an end of tape condition is assumed and the action is as described in (b) above.

d. If the code indicates anything but end of file, end of tape, or normal completion, a tape error has occurred. The message described in Section III B, indicating the type of error, is printed by the typewriter and control is passed to the error return of the master control program.

4. LEFRNDOFF

The LEFRNDOFF subroutine left shifts the AQ register the number of places indicated by the contents of index register 5 and rounds the A register.

5. MOONTIME

The MOONTIME subroutine computes the integral value of the current ephemeris hour and stores the addresses of the quantities to be interpolated. It computes the value of the interpolation argument P.

VI. PROGRAM LISTING

The next 23 pages show a APURT output of the MOONTRACK program in 3 parts:

Pp. 10-26: Printout of MOONTRACK program.

Pp. 27-29: Alphabetic list of program symbols.

Pp. 30-32: Numerical list of program symbols.

SPURT OUTPUT NO. 21C

FRACHTMAN# 7/14/64

MOONTRACK

NO.	OF	INSTRUCTIONS	THRU	03617
00000				01412
03611			THRU	C3616

MOUNTTRACK

CARD	L1 TO LABEL	TA STATEMENT	LCC	F	JKB	Y	NOTES
		OC000C MOUNTTRACK	PROGRAM				FRACHTMAN#7/14/64
		UE001 LUNAR	EQUALS				10U
		UC002 MUNITAPE	EQUALS				55
		UEC03 TAPEINPUT	EQUALS				35
		OC004 EPHEM	MEANS				C15*
		UL005 HENRY	U-TAG				MOUNTCNT*MOUNINIT
		FO 1*MOUNP					
		ENTRY	A*W(IGNORE)				
			STR A*W(MONITAPE)				
		ENT A*W(INTERUPT)					
			STR A*W(TAPEINPUT)				
		ENT 84*1165D					
		CL A*					
		OC016 ERASE	STR A*W(YRREMA(N+84))				
		UC017	B4*ERASE				
		UC020	ENT Q*W(EQUATOR)				
		GC021	MUL W(HRSEC)				
		OC022	LSH AQ*1*QPLUS				
		OE023	AQ*1				
		GC024	STR A*W(ERNMSEC)				
		OC025	ENT A*U(YEARMONTH)				
		UC026	SUB A*1961D				
		OC027	STR A*W(MONTHPRINT)				
		OC030	RSH AQ*300				
		UC031	DIV 4				
		OC032	STR A*W(YRREMAIN)				
		UE033	MUL 14610				
		OC034	STR Q*W(WHOLEYEAR)				
		OL035	ENT Q*W(YRREMAIN)				
		OC036	MUL 365D				
		UC037	RPL Y+Q*W(WHOLEYEAR)				
		UC040	RJP DAYFIND				
		OE041	ENT A*W(SAFE)				TRYAGAIN
		OC042	STR A*W(TAPEBLOCK)				
		OC043	IN EPHEM*W(EPHEMA)				
		UC044	ADD A*1477775				
		UC045	EX-FACT EPHEM*W(SRHIBIN)				
		OC046	STR A*W(TAPESEARCH)				
		UC047	EX-FACT EPHEM*W(TAPESEARCH)				
		UC050	JP \$				
		UEC51	IN EPHEM*W(EPHEMB)				
		UC052	RPL Y+1*W(TAPESEARCH)				
		OC053	EX-FACT EPHEM*W(SRHIBIN)				
		UC054	NO-UP				
		ULC55	EX-FACT EPHEM*W(TAPESEARCH)				
		OE056	JP \$				
		ULC57	IN EPHEM*W(EPHEMC)				
		ULC58	RPL Y+1*W(TAPESEARCH)				
		ULC59	EX-FACT EPHEM*W(SRHIBIN)				

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CAROS	L1 ID LABEL	TA STATEMENT	LOC	F	J	K	B	Y	NOTES
•	OC062	NO-OP	00055	12000	CCCCC				
•	UC063	EX-FCT	00056	13670	C1401				
•	OC064	JP \$	00057	61000	CC057				
•	OC065	IN EPHEM*W(EPHEMO)	0006C	73670	C0535				
•	OC066	RPL Y+1*W(TAPESEARCH)	00061	36030	C1401				
•	OC067	EX-FCT	00062	13670	C0762				
•	OC070	NO-OP	00063	12000	CCCCC				
•	UC071	EPHEM*W(SRHBIN)	00064	13670	01401				
•	OC072	EX-FCT	00065	61000	CC065				
•	OC073	JP \$	00066	73670	C0536				
•	OC074	IN EPHEM*W(EPHEME)	00067	36030	C1401				
•	OC075	RPL Y+1*W(TAPESEARCH)	0007C	13670	C0762				
•	OC076	EX-FCT	00071	12000	CCCCC				
•	OC077	NO-OP	00072	13670	C1401				
•	OC100	EX-FCT	00073	61000	CC073				
•	OC101	JP \$	00074	73670	00537				
•	OC102	IN EPHEM*W(EPHEMF)	00075	36030	C1401				
•	OC103	RPL Y+1*W(TAPESEARCH)	00076	13670	C0762				
•	OC104	EX-FCT	00077	12000	CCCCC				
•	OC105	NO-OP	00100	13670	01401				
•	OC106	EX-FCT	00101	61000	00101				
•	OC107	JP \$	00102	13670	C0765				
•	OC110	NURML	00103	65C00	C0352				
•	UC111	EPHEM*W(MONTIME)	00104	12410	01402				
•	UC112	ENT B4*L(RA0)	00105	11010	01405				
•	UC113	ENT A**L(SETINTAO)	00106	15010	01047				
•	UC114	STR A**L(SETINTAO)	00107	65C00	C105C				
•	UC115	RJP INTERPOL	0011C	10700	0C00C				
•	OC116	ENT Q*O*ANEG	00111	21630	C1001				
•	OC117	SUB A**W(TWOPIE)*APOS	00112	20C30	C1001				
•	OC120	A00 A**W(TWOPIE)	00113	C3C00	C0033				
•	UC121	RSH AQ*270	00114	23030	C077C				
•	UC122	OIV W(HRA0)	00115	14C30	CC621				
•	UC123	STR Q*W(RA2)	00116	10C00	CCCCC				
•	UC124	CL Q*	00117	C3C00	CC027				
•	UC125	RSH AQ*23D	0012C	23C30	CC771				
•	UC126	CIV W(MINSRA0)	00121	14C30	CC624				
•	UC127	STR Q*W(RA4)	00122	C3C00	CC036				
•	UC130	RSH AQ*300	00123	22C30	C0767				
•	UC131	MUL W(SRA0)	00124	C7200	00002				
•	UC132	ADO A*1	00125	20000	CC001				
•	UC133	STR A**W(RA6)	00126	15C30	CC627				
•	UC134	ENT B4*L(OECA0)	00127	12410	C1403				
•	UC135	ENT A**L(OECIFAO)	0013C	11010	C1406				
•	UC136	STR A**L(SETINTAO)	00131	15010	C1047				
•	UC137	RJP INTERPOL	00132	65CC0	C105C				
•	UC140	STR A**W(GMT2)	00133	15C30	CC777				
•	UC141	ENT Q*O*APOS	00134	10600	CCCCC				
•	OC142	CP A*	00135	15C40	CCCCC				
•	UC143	RSH AQ*220	00136	C3C00	CC026				

SPURT OUTPUT NO. 21C

MOONTRACK

FRACHTMAN#7/14/64

CARDS	L1 ID LABEL	TA STATEMENT	LDC	F	JKB	Y	NOTES
	UC144	DIV W(MINSRAD)	00137	23030	CC771		
	0C145	STR Q*W(DLN2)	00140	14030	00654		
	0C146	CL Q*	00141	10C00	0000C		
	0C147	RSH AQ*24D	00142	C3D00	0003C		
	0C150	DIV W(SECRAD)	00143	23030	C0775		
	UC151	STR Q*W(DLN4)	00144	14030	C0657		
	0C152	RSH AQ*30D	00145	C3C00	C0036		
	UC153	MUL W(SARAD)	00146	22D30	C0776		
	UC154	LSH AQ*2*QPLUS	00147	C72D0	C0002		
	0C155	ADD A*1	00150	20C00	00001		
	UC156	STR A*W(DLN6)	00151	15C30	00662		
	UC157	ENT A*W(GMT2)*ANEG	00152	11730	00707		
	UC160	JP \$+3	00153	610D0	C0156		
	0C161	ENT A*W(DLN2)	00154	11030	C0654		
	0C162	STR A*CPW(DLN2)	00155	15070	00654		
	UC163	ENT A*W(CELTIME)	00156	11030	63133		
	UC164	ENT Q*D*APOS	00157	10600	000CC		
	UC165	CP A*	00160	15C40	CC0CC		
	0C166	RSH AQ*26D	00161	C30C0	C0032		
	0C167	DIV W(HDAY)	00162	23030	00772		
	0C170	STR Q*W(GMT2)	00163	14030	00707		
	0C171	CL Q*	00164	10C00	000CC		
	0C172	RSH AQ*23D	00165	C3D00	00027		
	0C173	DIV W(MDAY)	00166	23030	00773		
	0C174	STR Q*W(GMT4)	00167	14C30	C0712		
	0C175	RSH AQ*300	00170	C3D00	C0036		
	0C176	MUL W(SDAY)	00171	22C30	C0774		
	0C177	LSH AQ*2*QPLUS	00172	C72D0	C0002		
	0C220	ADD A*1	00173	20D00	00001		
	UC2C1	STR A*W(GMT6)	00174	15C30	C0715		
	UC2C2	ENT A*W(CELTIME)*ANEG	00175	11730	63133		
	UC2C3	JP \$+3	00176	61000	00201		
	UC2C4	ENT A*W(GMT2)	00177	11C30	00707		
	0C2C5	STR A*CPW(GMT2)	00205	15D70	00707		
	0C2U6	ENT B4*L(DISTAD)	00201	12410	C1404		
	UC207	ENT A*L(DISTIFAD)	00202	11D10	01407		
	0C210	STR A*L(SETINTAD)	00203	15D10	C1047		
	UC211	RJP INTERPOL	00204	65D00	0105C		
	0C212	STR A*W(INITIAL18)	00205	15D30	C073C		
	UC213	ENT A*W(JULIANDAY)	00206	11030	01376		
	UC214	STR A*W(INITIAL3)	00207	15D30	C0565		
	0C215	ENT A*L(DAY)	00210	11C10	6315C		
	UC216	STR A*W(INITIAL12)	00211	15C30	C0576		
	UC217	RJP U(INTERCOM)	00212	65C20	63426		
	UC220	U-TAG INITIALJD*D	00213	C0555	CC0CC		
	UC221	RJP U(INTERCDM)	00214	65C20	63426		
	UC222	U-TAG RGHASC*O	00215	C0577	CC0CC		
	UC223	RJP U(INTERCOM)	00216	65C20	63426		
	UC224	U-DLN*O	00217	C0632	CC0CC		
	UC225	RJP U(INTERCOM)	0022C	65C20	63426		

FRACHTMAN#7/14/64

LNRDS	LI ID L'BL	TA STATEMENT	MOONTRACK	FRACHTMAN#7/14/64	LOC	F	JKB	Y	NCTES
.	UC226	U-TAG RJP U(INTERCOM)	INITIALDATA*0	00221	C0566	CC000C			
.	UC227	U-TAG RJP GM*0		00222	65020	63426			
.	UC230	U-TAG RJP U(INTERCOM)		00223	C0665	CCCC			
.	UC231	U-TAG RJP INITIALDIS*C		00224	65020	63426			
.	UC232	U-TAG RJP U(INTERCOM)		00225	C0720	CCCC			
.	UC233	U-TAG RJP INITIALBOD*0		00226	65C20	63426			
.	UC234	RPL Y+1*L(MOONINIT) JP A	ENTRY	00227	C0731	CCCC			
.	UC235	AIRPORT	RPL Y+1*L(MOONINIT)	00230	36010	CCCC			
.	UC236	MOONCONT	RPL Y+1*L(MOONCONT)	00231	61070	CCCC			
.	UC237	MOONCONT	RJP MOONTIME	00232	61000	CCCC			
.	UC240	UC241 HARVARD	RJP B4*L(RA(AD)	00233	36C10	C0232			
.	UC241	UC242 HARVARD	ENT A*L(RA(DIFAD)	00234	65C00	00352			
.	UC242	UC243	STR A*L(SETINTAD)	00235	12410	01402			
.	UC243	UC244	RJP INTERPOL	00236	11010	01405			
.	UC244	UC245	RSH AQ#300	00237	15C10	01047			
.	UC245	UC246	MUL W(REVSRADIAN)	00240	65C00	0105C			
.	UC246	UC247	RJP MOOSE*QPOS	00241	C3C00	CC036			
.	UC247	UC250	ADD A*1	00242	22C30	CC761			
.	UC250	UC251	STR A*w(RA)	00243	60200	00245			
.	UC251	UC252 MOOSE	ENT Q*w(NUMDERIV)	00244	20000	CC001			
.	UC252	UC253	MUL W(RHRSEC)	00245	15030	63002			
.	UC253	UC254	ENT B5*1	00246	10030	C1041			
.	UC254	UC255	RJP LEFRNDUFF	00247	22030	0100C	B 40		
.	UC255	UC256	STR A*w(RADOT)	00250	12500	CCU01			
.	UC256	UC257	ENT B4*L(OECDAD)	00251	65C00	C1364			
.	UC257	UC260	ENT A*L(OECDIFAD)	00252	15C30	63003			
.	UC260	UC261	STR A*L(SETINTAD)	00253	12410	01403			
.	UC261	UC262	RJP INTERPOL	00254	11010	C1406			
.	UC262	UC263	RSH AQ#300	00255	15010	01047			
.	UC263	UC264	MUL W(REVSRADIAN)	00256	65C00	C105C			
.	UC264	UC265	ADD A*1	00257	C3000	00036			
.	UC265	UC266	STR A*w(DEC)	00258	22C30	CC761			
.	UC266	UC267	ENT Q*w(NUMDERIV)	00259	00260	00527			
.	UC267	UC270	MUL W(RHRSEC)	00261	60700	00264			
.	UC270	UC271 BLAVER	ENT B5*1	00262	60200	00001			
.	UC271	UC272	RJP LEFRNDUFF	00263	20000	00264			
.	UC272	UC273	STR A*w(OECDOT)	00264	15030	63003			
.	UC273	UC274	ENT B4*L(OIISTAD)	00265	10030	C1041			
.	UC274	UC275	ENT A*L(DISTIFAD)	00266	22030	0100C			
.	UC275	UC276	RJP INTERPOL	00267	12500	00001			
.	UC276	UC277	STR A*w(RADIUS)	00270	65000	01364			
.	UC277	UC300	ENT Q*w(NUMDERIV)	00271	15C30	6301C			
.	UC300	UC305	MUL W(ERNMSEC)	00272	12410	014C4			
.	UC305	UC306	ENT B5*4	00273	11010	C1407			
.	UC306	UC307	RJP LEFRNDUFF	00274	15C10	C1047			
.	UC307			00275	65C00	C105C			
.				00276	15C30	63006	822		
.				00277	10030	C1041			
.				00300	22030	CC777			
.				00301	12500	CCCC			
.				00302	65C00	C1364			

SPURT OUTPUT NO. 21C

LAROS	LI	IO	LABEL	TA STATEMENT	MOONTRACK	FRACHMAN•7/14/64	LOC	F	J	K	B	Y	NOTES
			UC310	STR A•W(RA01US00T)			00303	15030	63C11				B24
			UC311	SEAPORT	EXIT		00304	61010	C0232				
			UC312	FLATNEG	CP A*		00305	15040	0000C				
			UC313	A•W(HALFOAY)*APOS	SUR LESSONE		00306	21630	0076C				
			UC314	JP AQ•300	RSH AQ•300		00307	61000	C0321				
			UC315	DIV W(HALFOAY)	JP DIV		0031C	C3000	CC036				
			UC316	LSH AQ•300	LSH AQ•300		00311	23030	0076C				
			UC317	SUB A•1	SUB A•1		00312	C7000	CC036				
			UC320	JP TWOLESS•AZERO	JP TWOLESS•AZERO		00313	21000	CCC01				
			UC321	JP TWOLESS•ANEQ	JP TWOLESS•ANEQ		00314	60400	C0317				
			UC322	ENT A•-3•SKIP	ENT A•-3•SKIP		00315	60700	00317				
			UC323	ENT A•-2	ENT A•-2		00316	11140	77774				
			UC324	STORE	JP STORE		00317	11040	77775				
			UC325	JP STORE	JP STORE		00320	61000	CC34C				
			UC326	ENT A•-1	ENT A•-1		00321	11040	77776				
			UC327	JP STORE	JP STORE		00322	61000	C034C				
			UC330	DAYIND	ENTRY A•W(CELTIME)*APOS		00323	61000	CC00C				
			UC331	JP FLATNEG	JP FLATNEG		00324	11630	63133				
			UC332	SUB A•W(HALFOAY)*APOS	SUB A•W(HALFOAY)*APOS		00325	61000	00305				
			UC333	JP LESSONE	JP LESSONE		00326	21630	C076C				
			UC334	RSH AQ•300	RSH AQ•300		00327	61000	00321				
			UC335	DIV W(HALFOAY)	DIV W(HALFOAY)		00330	C3000	0C036				
			UC336	LSH AQ•300	LSH AQ•300		00331	23030	C076C				
			UC337	SUB A•1	SUB A•1		00332	C7000	C0036				
			UC340	JP CERO•AZERO	JP CERO•AZERO		00333	21000	CCC01				
			UC341	JP CERO•ANEG	JP CERO•ANEG		00334	60400	00337				
			UC342	ENT A•1•SKIP	ENT A•1•SKIP		00335	60700	00337				
			UC343	ENT A•0	ENT A•0		00336	11100	CCC01				
			UC344	STR A•W(DAYINCRMT)	STR A•W(DAYINCRMT)		00337	11000	CCC0C				
			UC345	STORE	A00 A•W(WHOLEYEAR)		00340	15C30	CC351				
			UC346	A00 A•24373000D	A00 A•24373000D		00341	20030	C1375				
			UC347	A00 A•L(DAY)	A00 A•L(DAY)		00342	20030	03614				
			UC350	STR A•W(JULIANOAY)	STR A•W(JULIANOAY)		00343	20010	6315C				
			UC351	SUB A•24381450	SUB A•24381450		00344	15030	C1375				
			UC352	SUB A•W(DAYINCRMT)	SUB A•W(DAYINCRMT)		00345	21030	03615				
			UC353	STR A•W(SAFE)	STR A•W(SAFE)		00346	21030	03351				
			UC354	EXIT O	JP NEGTIME		00347	15030	C1411				
			UC355	DAYINCRMT	JP NEGTIME		00350	61C10	C0323				
			UC356	MONTIME	ENT A•W(CELTIME)		00351	60000	CCC0C				
			UC357	JP MONTIME	A00 A•W(OELTATEE)*APOS		00352	61000	CCC0C				
			UC360	JP NEGTIME	JP NEGTIME		00353	11C30	63133				
			UC361	ENT B4•5760	ENT B4•5760		00354	20630	63316				
			UC362	RSH AQ•300	RSH AQ•300		00355	61000	C0406				
			UC363	DIV W(HOUR)	DIV W(HOUR)		00356	12400	C11CC				
			UC364	STR Q•W(TIME2)	STR Q•W(TIME2)		00357	C3C00	CC036				
			UC365	CL Q*	CL Q*		00360	23C30	CUT66				
			UC366	DIV W(HOUR)	DIV W(HOUR)		00361	14C30	0141C				
			UC367	LSH AQ•290	LSH AQ•290		00362	10C00	CCC0C				
			UC370				00363	23030	CC766				
			UC371				00364	C7C00	CC035				

AROS	L1 TO L18EL	TA STATEMENT	MOONTRACK		FRACHTMAN#7/14/64		F JKB Y	NOTES
			L0C	F	L0C	F		
• UC372	SEL CL*W(KFY)	00365 52030 C1C13						
• UC373	STR A*W(P)	00366 15C30 C1C22						
• UC374	ENT A*W(TIME2)	00367 11C30 0141C						
• UC375	LSH A*3	00370 C6000 000C3						
• UC376	A00 A*W(EPEHEM+2+B4	00371 20004 01414						
• UC377	STR A*L(RAAO)	00372 15010 C14C2						
• UC400	ADD A*1	00373 20000 00001						
• UC401	STR A*L(RAOIFA0)	00374 15C10 01405						
• UC4C2	ADD A*1	00375 20000 C0001						
• UC4U3	STR A*L(OECA0)	00376 15C10 C14C3						
• UC4U4	ADD A*1	00377 20000 00001						
• UC4C5	STR A*L(OECA0FA0)	00400 15010 01406						
• UC4C6	ADD A*1	00401 20000 C0001						
• UC4U7	STR A*L(OISTAO)	00402 15C10 C1404						
• UC410	ADD A*1	00403 20000 C0001						
• UC411	STR A*L(OISTOIFAO)	00404 15010 C14C7						
• UC412	EXIT CL	00405 61010 C0352						
• UC413	NETIME B4*	00406 12400 C000C						
• UC414	SUR A*W(KEY)	00407 21030 C1013						
• UC415	JP WORLDFAIR	00410 61000 00357						
• UC416	STATUSCK ENTRY	00411 61000 C000C						
• UC417	STR EPHEM*W(TAPSTAT)	00412 17670 C0524						
• UC420	ENT A*W(TAPSTAT)	00413 11020 00524						
• UC421	RSH A*110	00414 C2000 C0013						
• UC422	STR A*W(TAPSTAT+1)	00415 15030 C0025						
• UC423	RPL Y+1*L(SATUSCK)	00416 36010 00411						
• UC424	ENT B3*L(TAPSTAT+1)	00417 12310 C0525						
• UC425	RIL	00420 6000U C000C						
• UC426	JP STATACT+R3	00421 61003 CC422						
• UC427	STATACT JP BUST	00422 61000 00476						
• UC430	JP BUST	00423 61000 C0476						
• UC431	JP BUST	00424 61000 C0476						
• UC432	JP BUST	00425 61000 C0476						
• UC433	JP BUST	00426 61000 00476	4	SEQ	ERR SYNC	20		
• UC434	JP BUST	00427 61000 C0476	5	REWINDING	24			
• UC435	JP BUST	00430 61000 C0476	6	CHAR CCNT	30			
• UC436	JP BUST	00431 61000 C0476	7	ILLEGAL	34			
• UC437	EXIT	00432 61010 00411	10	40	NORMAL			
• UC440	JP BUST	00433 61000 C0476	11	REPEAT	44			
• UC441	JP BUST	00434 61000 C0476	12	SEC ERR CCNT	50			
• UC442	JP ENOFILC	00435 61000 C0472	13	ECF	54			
• UC443	JP CANIFINO	00436 61000 C0442	14	EOT	6C			
• UC444	JP BUST	00437 61000 C0476	15	NNSLCH				
• UC445	JP BUST	0044C 61000 C0476	16	ABN F C	70			
• UC446	JP BUST	00441 61000 C0476	17	INTERLOCK	74			
• UC447	EX-FACT EPHEM*W(RENINONO)	00442 13670 00765						
• UC450	ENT B4*L(MUNTHPRINT)	00443 12410 C0743						
• UC451	ENT A*W(YEARPRINT+B4)	00444 11034 C1002						
• UC452	STR A*W(NODATA2)	00445 15C30 CC546						
• UC453	ENT B4*L(YEARMONTH)	00446 12410 63147						

MOONTRACK

CARDS	L1 ID	LABEL	TA STATEMENT	LOC	F	J	K	B	Y	NOTES
UC454			ENT A*W(MONTIHPR(NI+84))	00447	11034	00743				
UC455			RPL A+Y*W(NODATA2)	00450	24030	00546				
UC456			CL A*	00451	11000	00000				
UC457			ENT Q*L(BARKIER)	00452	10010	00473				
UC460			DIV 12	00453	23000	00012				
UC461			ADD A*60	00454	20000	0006C				
UC462			STR A*U(IMPERIAL)	00455	15020	01377				
UC463			CL A*	00456	11000	00000				
UC464			DIV 12	00457	23000	00012				
UC465			JP ALBERT*AZERO	00460	60400	00462				
UC466			ADD A*60	00461	20000	0006C				
UC467		ALBERT	LSH A*6	00462	16000	00006				
UC470			ADD A*U(IMPERIAL)	00463	20020	01377				
UC471			LSH A*6	00464	16000	00006				
UC472			ADD A*3105000005	00465	20030	03616				
UC473			STR A*W(NODATA3)	00466	15030	00552				
UC474			RJP U(INTERCOM)	00467	65020	63426				
UC475			U-TAG NODATA*0	00470	C0540	00000				
UC476			JP L(MOONINIT)	00471	61010	00002				
UC477		ENDFILE	RPL Y+1*L(IMPERIAL)	00472	36010	01377				
UC500		BARRIER	SUB A*12D	00473	21000	00014	MGCN			
UC501			JP CANTFIND*AZERO	00474	60400	00442				
UC502			JP TRYAGAIN	00475	61000	00034				
UC503		BUST	EX-FCI EPHEM*W(REWINDNC)	00476	13670	00765				
UC504			ENT A*L(TAPSTAT+1)	00477	11010	00525				
UC505			RSH A*1	00500	C20000	00001				
UC506			ADD A*60	00501	20000	0006C				
UC507			LSH A*6	00502	C6000	0C006				
UC510			STR A*L(TAPSTAT+2)	00503	15010	0C526				
UC511			ENT A*L(TAPSTAT+1)	00504	11010	00525				
UC512			SEL CL*X77776	00505	52040	77776				
UC513			LSH A*2	00506	C6000	000C2				
UC514			ADD A*60	00507	20000	0006C				
UC515			ADD A*L(TAPSTAT+2)	00510	20010	0C526				
UC516			STR A*L(TAPEBUST1+3)	00511	15C10	00522				
UC517			RJP U(INTERCOM)	00512	65020	63426				
UC520			U-TAG TAPEBUST*0	00513	C0515	CC000				
UC521			JP L(MOONINIT)	00514	61010	00002				
UC522		TAPEBUST	FD O*A	00515	C6050	50505				
UC523			-0 TAPEBUST1	00516	77777	00517				
UC524		TAPEBUST1	FD O*IIC	00517	16161	610C5				
UC525			FD O*STATUS	00520	30310	63132				
UC526			FD 2*S S1	00521	30C50	53061				
UC527			-0 -0	00523	77777	77777				
UC530		TAPSTAT	+0	00524	C0000	CC000				
UC531			+0	00525	C0000	CC000				
UC532			+0	00526	C0000	CC000				
UC533		NLGDEC	JP BEAVER*QNEG	00527	60300	00264				
UC534			SUB A*1	00530	21000	CC001				

CARD	L1	I0	LABEL	TA	STATEMENT	LOC	F	JKB	Y	NCTES
•	UC535			JP	BEAVER	00531	61000	CC264		
•	UC536		EPEHMA	U-TAG	AEPHEM+1910*AEPHEM	00532	C1711	01412		
•	UC537		EPHEMB	U-TAG	AEPHEM+3830*AEPHEM+1920	00533	C2211	01712		
•	UC540		EPEHEMC	U-TAG	AEPHEM+5750*AEPHEM+3840	00534	C2511	02212		
•	UC541		EPEHEMU	U-TAG	AEPHEM+7670*AEPHEM+5760	00535	C3011	02512		
•	UC542		EPEHEME	U-TAG	AEPHEM+9590*AEPHEM+7690	00536	C3311	03012		
•	UC543		EPEHEMF	U-TAG	AEPHEM+1151D*AEPHEM+9600	00537	C3611	03312		
•	UC544		NUDATA	FD	O*A	0054C	C6050	50505		
•	UC545		NUDATA1	-O	NOODATA1	00541	77777	C0542		
•	UC546		NUDATA2	FO	O*MOON	00542	22242	42305		
•	UC547		NUDATA3	FO	O*EPEHM	00543	12251	51222		
•	UC550			FO	O*ERIS	00544	12271	63005		
•	UC551			FO	O*FOR	00545	13242	70505		
•	UC552			FO	O*63/63	00546	66637	46663		
•	UC553			FD	O* NOT	00547	C5232	431C5		
•	UC554			FD	O*AMONG	00550	C6222	42314		
•	UC555			FD	O* FIRS	00551	C5131	6273C		
•	UC556			FD	O*T	00552	31050	505C5		
•	UC557			FD	O*FILES	00553	13162	1123C		
•	UC560			-O		00554	77777	77777		
•	UC561		INITIALD	FD	O*A	00555	C6050	50505		
•	UC562		INITIAL3	U-TAG	INITIAL2*INITIAL1	00556	C0563	C0557		
•	UC563		INITIAL1	FD	O*JULIA	00557	17322	11606		
•	UC564		INITIAL10	FO	2*N DAY	0056C	23051	10636		
•	UC565			-O		00561	C5050	505C5		
•	UC566		INITIAL2	FO	O*O	00562	77777	77777		
•	UC567			-O	INITIAL3	00563	11050	50505		
•	UC570		INITIAL3	O		00564	77777	C0565		
•	UC571		INITIALDAT	FD	O*A	00565	C0000	C0C0C		
•	UC572			U-TAG	INITIAL11*INITIAL10	00566	C6050	50505		
•	UC573		INITIAL10	FD	3*DAY OF YEAR	00567	C0574	0057C		
•	UC574			-O		0057C	11063	61206		
•	UC575		INITIAL11	FD	O*O	00572	27C50	5C5C5		
•	UC576			-O	INITIAL12	00573	77777	77777		
•	UC577		INITIAL12	O		00574	11C50	505C5		
•	UC600		RHTASC	FD	O*A	00575	77777	0C576		
•	UC601			O	RA1	00576	C0000	OC0CC		
•	UC602			FO	O*O	00577	C6C50	5C5C5		
•	UC603			O	RA2	00601	11050	50505		
•	UC604			FD	O*A	00602	C0C00	CC621		
•	UC605			O	RA3	00603	C6050	50505		
•	UC606			FD	O*O	00604	C0C00	CC622		
•	UC607			O	RA4	00605	11050	505C5		
•	UC610			FC	O*A	00606	COC00	CC624		
•	UC611			O	RA5	00607	C6050	5C5C5		
•	UC612			FD	O*X2B23	00611	35620	76263		
•	UC613			O	RA6	0C612	COC00	CC627		

CARD#	L1	I0	LABEL	TA STATEMENT	LOC	F	JKRY	NOTES
•	UC614			FO O*A	00613	C6C50	505C5	
•	UC615			-0 RA7	00614	77777	CC63C	
•	UC616	RAL		FD 3*RIGHT ASC	00615	27161	41531	
•	UC617			-0	00616	C5063	C1005	
•	UC620	RA2		0	00617	C5C50	50505	
•	UC621	RA3		1505	00620	77777	77777	
•	UC622			-0	00621	COCOO	OCCC	
•	UC623	RA4		U	00622	COCOO	C15C5	
•	UC624	RA5		2205	00623	77777	77777	
•	UC625			-0	00624	COCOO	COCCC	
•	UC626	RA6		0	00625	COCOO	022C5	
•	UC627	RA7		30	00626	77777	77777	
•	UC630			-0	00627	C0000	0000C	
•	UC631	DLN		FO O*A	00630	C0000	CC03C	
•	UC632			U QLN1	00631	77777	77777	
•	UC633			FO O*A	00632	C6050	50505	
•	UC634			0 DLN2	00633	C0000	0065C	
•	UC635			FO O*A	00634	11050	50505	
•	UC636			0 DLN3	00635	COCOO	C0654	
•	UC637			FO O*A	00636	C6050	50505	
•	UC640			0 QLN4	00637	C0000	00655	
•	UC641			FO O*A	00640	11050	50505	
•	UC642			0 QLN5	00641	C0000	C0657	
•	UC643			FO O*X2B23	00642	C6C50	50505	
•	UC644			0 DLN6	00643	C0000	0066C	
•	UC645			FO O*A	00644	35620	76263	
•	UC646			-0 DLN7	00645	COCOO	00662	
•	UC647	DLN1		FO 3*DECLINATION	00646	C6050	50505	
•	UC650			-0	00647	77777	00663	
•	UC651	DLN2		U	00650	11121	02116	
•	UC652	DLN3		11U5	00651	23063	11624	
•	UC653			-0	00652	23C50	50505	
•	UC654	DLN4		0	00653	77777	77777	
•	UC655	DLN5		7205	00654	C0000	0000C	
•	UC656			-U	00655	77777	77777	
•	UC657	DLN6		0	00656	C0000	OCCC	
•	UC660	DLN7		52	00656	01105	01105	
•	UC661			-U	00657	77777	77777	
•	UC662	GMT		FO O*A	00660	C0000	C0052	
•	UC663			U GMT1	00661	77777	77777	
•	UC664			FO O*A	00662	C0000	OCCC	
•	UC665			U GMT2	00663	00663	C0052	
•	UC666			FO O*A	00664	77777	77777	
•	UC667			U GMT3	00665	C6050	50505	
•	UC670			FO O*D	00666	C0000	CC71C	
•	UC671			U GMT4	00667	11050	505C5	
•					00673	11050	505C5	
•					00674	COCOO	CC712	

FRACHTMAN#7/14/64

CAROS	LI	IO	LABEL	TA STATEMENT	MOONTRACK	FRACHTMAN#7/14/64	LOC	F	JKB	Y	NCTES
			OC672	FO U*A 0 GMT5			00675	C6050	50505		
			OC673	FO 0*X2B23 0 GMT6			00676	C0000	C0713		
			OC674	FO 0*X2B23 0 GMT6			00677	35620	76263		
			OC675	FO 0*A 0 GMT6			00700	C0000	00715		
			OC676	FO 0*A 0 GMT7			00701	06050	50505		
			OC677	-0 FO 3*UNIVERSAL TIME			00702	77777	C0716		
			OC700	GMT1			00703	32231	63312		
							00704	27300	62105		
							00705	31162	21205		
							00706	77777	77777		
							00707	C0000	00000		
							00710	C0000	C1505		
							00711	77777	77777		
							00712	C0000	00000		
							00713	C0000	02205		
							00714	77777	77777		
							00715	C0000	00000		
							00716	C0000	0003C		
							00717	77777	77777		
							00720	C6050	50505		
							00721	C0726	00722		
							00722	11163	03106		
							00723	23101	20505		
							00724	12052	70505		
							00725	77777	77777		
							00726	35660	76262		
							00727	77777	0073C		
							00730	C0000	00000		
							00731	06050	50505		
							00732	C0737	00733		
							00733	24071	7121C		
							00734	31050	50505		
							00735	C5050	50505		
							00736	77777	77777		
							00737	C6050	5C505		
							0074C	77777	C0741		
							00741	22242	4230C		
							00742	77777	77777		
							00743	C0000	00000		
							00744	C0610	00000		
							00745	C0620	00000		
							00746	C0630	00000		
							00747	C0640	00000		
							00750	C0650	00000		
							00751	C0660	00000		
							00752	C0670	00000		
							00753	C0700	00000		
							00754	C0710	00000		
							00755	61600	00000		
							00756	61610	CCCCC		

CARDS	L1 ID	LABEL	TA STATEMENT	LUC	F	JKBY	NOTES
OC750			6162000000	00757	61620	CC00C	
OC751		HALFDAY	1000000000	00760	10000	CC00C	
OC752		REVRDAOIAN	2427630154	00761	24276	30154	DEC C.63661977B29
OC753		S ₁ HIBIN	5600000002	00762	56CC0	CC002	
OC754		IGNORE	6000000000	00763	60000	CC00C	
OC755		INTERRUPT	RJP STATUSCK	00764	65000	00411	NO INT
OC756		REWINDNO	2010000002	00765	20100	CC0C2	1 B 1118481180
OC757		HOUR	0052525253	00766	00525	25253	DEC 13750.987815 43
OC760		SRAO	3266677126	00767	32666	77126	DEC 20C/P1
OC761		HRAD	103U124435	0077C	10301	24435	DEC .26117939B29 P1
OC762		MINSRAD	2167643241	00771	21676	43241	/12 DEC .55850536829 12
OC763		HDAY	1252525250	00772	12525	2525C	DEC .33333333829 8/
OC764		MDAY	2660266026	00773	26602	66026	DEC .71111111829 2E
OC765		SUDAY	2506000000U	00774	25060	CC00C	86400.0000812
OC766		SECRAO	2304045527	00775	23040	45527	DEC .59573905829 2E
OC767		SARA0	3113343172	00776	31133	43172	DEC 13P1/432C0 206264.B1B11 64
OC770		ERNMSEC	0	00777	00000	0000C	B00/P1
OC771		RHRSEC	2215053171	0100C	22150	53171	DEC .569888889B29 2E
OC772		TWOPIE	3110375523	01001	31103	75523	DEC .569888889B29 84C 6.2831853826
OC773		Y ₂ ARPRINT	000U746661	01002	00007	46661	
OC774			0000746661	01003	00007	46662	
OC775			0000746662	01004	00007	46663	
OC776			0000746663	01005	00007	46664	
OC777			0000746664	01006	00007	46665	
01000			0000746665	01007	00007	46666	
01001			0000746666	01008	00007	46667	
01002			0000746667	01009	00007	46667C	
01003			0000746671	01010	00007	46671	
01004		KEY	4000000000	01011	40000	0000C	
01005		FIRSTOFF	0	01012	00000	CC00C	
01006		BETA	0	01013	00000	CC00C	
01007		GAMMA	0	01014	00000	CC00C	
01010		DELTA	0	01015	00000	CC00C	
01011		EPSILON	U	01016	00000	CC00C	
01012		FUNCTION	0	01017	00000	CC00C	
01013		P	0	01018	00000	CC00C	
01014		HALF	200000000U	01019	20000	CC00C	
01015		D ¹ IN ^B	0	01020	20000	CC00C	
01016		D ¹ IN2CP ^B	U	01021	20000	CC00C	
01017		E ¹ 2RM2UMA	U	01022	20000	CC00C	
01020		HESSEL	U	01023	20000	CC00C	
01021			0	01024	20000	CC00C	

CARDS	L1 ID L HCL	TA STATEMENT	MOUNTRACK	LCC	F JKR Y	NOTES
*	01022	U		01031	CUCOO CCCCC	
*	01023	U		01032	CUCOO CCOCC	
*	01024 P,QMP	U		01033	COCOO CCCCC	
*	01025 P,QMP6	U		01034	COCOO CC0CC	
*	01026 PSGMP6	U		01035	COCOO CCCCC	
*	01027 THIKO	1252525252		01036	12525 25252	
*	01030 SIXTH	0525252525		01037	C5252 52525	
*	01031 KENNEOY	0		0104C	COCOO CC0CC	
*	01032 NODDERIV	U		01041	COCOO CC0CC	
*	01033 FESSSEL	U		01042	COCOO CC0CC	
*	01034	0		01043	COCOO CCCCC	
*	01035	0		01044	COCOO CC0CC	
*	01036	0		01045	COCOO CC0CC	
*	01037	0		01046	COCOO CC0CC	
*	01040 SUTINTAO	0	ENTRY	01047	CCC00 CC0CC	
*	01041 INTERPOL		ENT Q*-20	0105C	61000 CC0CC	
*	01042		RPL Y+Q*L(SETINTAO)	01051	10C40 77757	
*	01043		ENT B3*L(SETINTAC)	01052	34010 C1047	
*	01044		ENT A*W(O+B3)	01053	12310 C1C47	
*	01045		STR A*W(FIRSTOFF)	01054	11033 CCCCC	
*	01046		ENT B3*10+B3	01055	15030 C1014	
*	01047		ENT A*W(U+B3)	01056	12303 CC01C	
*	0105C		STR A*W(BETA)	01057	11033 CCCCC	
*	01051		ENT B3*10+B3	0106C	15030 C1015	
*	01052		ENT A*W(U+B3)	01061	12303 CC01C	
*	01053		STR A*W(GAMMA)	01062	11033 CC0CC	
*	01054		ENT B3*10+B3	01063	15C30 C1016	
*	01055		ENT A*W(U+B3)	01064	12303 CC01C	
*	01056		STR A*W(DELTA)	01065	11033 CCCCC	
*	01057		ENT B3*10+B3	01066	15C30 C1C17	
*	0106C		STR A*W(BETA)	01067	12303 CCC1C	
*	01061		ENT A*W(U+B3)	0107C	11033 COCC	
*	01062		STR A*W(EPSILON)	01071	15030 C102C	
*	01063		ENT A*W(BESSEL)	01072	11030 C1C27	
*	01064		STR A*W(DELTA)	01073	21C30 C1015	
*	01065		ADD A*W(BETA)	01074	15030 C1C24	
*	01066		STR A*W(UMINB)	01075	2CC30 C1024	
*	01067		STR A*W(BESSEL)	01076	15C30 C1C27	
*	0107C		ENT A*W(DELTA)	01077	11C30 C1C17	
*	01075		ADD A*W(BETA)	0110C	2CC30 C1C15	
*	01071		SUB A*W(GAMMA)	01101	21C30 C1C16	
*	01072		SUB A*W(GAMMA)	011C2	21C30 C1016	
*	01073		STR A*W(OMIN2CPLA)	01103	15C30 C1C25	
*	01074		ENT A*W(EPSILON)	01104	11C30 C1C2C	
*	01075		SUB A*W(FIRSTOFF)	01105	21C30 C1C14	
*	01076		SUB A*W(BESSEL)	01106	21C30 C1C27	
*	01077		STR A*W(EP2RM2DMA)	01107	15C30 C1026	
*	011C0		ENT Q*W(P)	0111C	10C30 C1C22	
*	011C1		MUL W(GAMMA)	01111	22C30 C1C16	
*	011C2		AQ*1	01112	C7CC0 CCCCC	
*	011C3		LSH			

MOONTRACK

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CARDS	L1 ID LABEL	TA STATEMENT	LOC	F	JKB	Y	NOTES
• 01104		STR A*W(BESSEL+1)	01113	15030	C103C		
• 01105		STR A*W(BESSEL)*AP0S	01114	15630	C1027		
• 01106		JP NEGESS1	01115	61000	C135C		
• 01107		LSH AQ*29D	01116	C7000	00035		
• 01110	STOR1	SEL CL*W(KEY)	01117	52030	01013		
• 01111	STOR1	STR A*W(FBESSEL)	0112C	15C30	C1042		
• 01112		STR A*W(FBESSEL+1)	01121	15C30	01043		
• 01113		ENT Q*W(P)	01122	10030	C1022		
• 01114		MUL W(P)	01123	22030	01022		
• 01115		ENT B5*1	01124	12500	000C1		
• 01116		RJP LEFRNDUFF	01125	65000	01364		
• 01117		SUB A*W(P)	01126	21030	01022		
• 01120		STR A*W(PSQMP)	01127	15030	01034		
• 01121		RSH AQ*3UD	0113C	C3000	00036		
• 01122		MUL W(DMINB)	01131	22C30	01024		
• 01123		RSH AQ*1	01132	C3000	00001		
• 01124		STR A*W(BESSEL+2)*AP0S	01133	15630	01031		
• 01125		JP NEGESS2	01134	61000	C1353		
• 01126		LSH AQ*29D	01135	C7000	00035		
• 01127		SEL CL*W(KEY)	01136	52030	01013		
• 01130	STOR2	STR A*W(FBESSEL+2)	01137	15C30	C1044		
• 01131		ENT A*W(PSQMP)	0114C	11030	01034		
• 01132		RSH AQ*30D	01141	C3000	00036		
• 01133		DIV 6*AZERO	01142	23400	00006		
• 01134		JP REMAINDER	01143	61000	C125C		
• 01135	L(NCOLN	STR Q*W(PSQMP6)	01144	14C30	C1035		
• 01136		ENT Q*W(P)	01145	10030	01022		
• 01137		SUB Q*W(HALF)	01146	27030	01023		
• 01140		MUL W(PSQMP6)	01147	22030	C1035		
• 01141		RJP LEFRNDUFF	0115C	65000	01364		
• 01142		RSH AQ*30D	01151	C3000	00036		
• 01143		MUL W(DMIN2CPBLB)	01152	22030	01025		
• 01144		LSH AQ*1	01153	C7000	00001		
• 01145		STR A*W(BESSEL+3)*AP0S	01154	15630	01032		
• 01146		JP NEGESS3	01155	61000	01356		
• 01147		LSH AQ*29D	01156	C7000	00035		
• 01150	STOR3	SEL CL*W(KEY)	01157	52030	01013		
• 01151		STR A*W(FBESSEL+3)	01160	15C30	01045		
• 01152		ENT Q*W(PSQMP6)	01161	10030	C1035		
• 01153		SUB Q*W(THIRD)	01162	27030	C1036		
• 01154		MUL W(PSQMP)	01163	22C30	01034		
• 01155		RJP LEFRNDUFF	01164	65000	C1364		
• 01156		RSH AQ*30D	01165	C3000	CC036		
• 01157		MUL W(EP2BM2DMA)	01166	22C30	01026		
• 01160		RSH AQ*2	01167	C3000	00002		
• 01161		STR A*W(BESSEL+4)*AP0S	0117C	15630	01033		
• 01162		JP NEGESS4	01171	61000	01361		
• 01163		LSH AQ*29D	01172	C7000	CC035		
• 01164		SEL CL*W(KEY)	01173	52030	C1013		
• 01165	STOR4	STR A*W(FBESSEL+4)	01174	15C30	C1046		

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MOONTRACK

CARDS	L1	ID	LABEL	RA STATEMENT	LOC	F	JKB	Y	NOTES
•	01166			ENT A*W(FBESSEL)	01175	11C30	C1042		
•	01167			SEL CP*W(FBESSEL+2)	01176	51030	01044		
•	01170			JP FLOTEST1*APOS	01177	60600	01262		
•	01171		NUFL01	ENT Q*W(BESSEL+2)	01200	10030	C1031		
•	01172		FIX1	RPL Y+Q*W(BESSEL)	01201	34030	C1027		
•	01173			ENT A*W(FBESSEL+2)	01202	11030	C1044		
•	01174			RPL A+Y*W(FBESSEL)	01203	24030	C1042		
•	01175			SEL CP*W(FBESSEL+3)	01204	51030	C1045		
•	01176			JP FLOTEST2*APOS	01205	60600	C1304		
•	01177		NUFL02	ENT Q*W(BESSEL+3)	01206	10030	C1032		
•	01200		FIX2	RPL Y+Q*W(BESSEL)	01207	34030	01027		
•	01201			ENT A*W(FBESSEL+3)	01210	11030	C1045		
•	01202			RPL A+Y*W(FBESSEL)	01211	24C30	C1042		
•	01203			SEL CP*W(FBESSEL+4)	01212	51030	01046		
•	01204			JP FLOTEST3*APOS	01213	60600	01326		
•	01205		NUFL03	ENT Q*W(BESSEL+4)	01214	10030	C1033		
•	01206		FIX3	RPL Y+Q*W(BESSEL)	01215	34C30	C1027		
•	01207			ENT A*W(FBESSEL+4)	01216	11030	C1046		
•	01210			RPL A+Y*W(FBESSEL)	01217	24030	01042		
•	01211			ENT Q*W(P)	01220	10030	C1022		
•	01212			SUB Q*W(HALF)	01221	27030	C1023		
•	01213			MUL W(DMINB)	01222	22030	C1024		
•	01214			CL B5*	01223	12500	0C00C		
•	01215			RJP LEFRNOOFF	01224	65000	C1364		
•	01216			STR A*W(KENNEOY)	01225	15030	C104C		
•	01217			ENT Q*W(POMP)	01226	10030	01034		
•	01220			ADD Q*W(SIXTH)	01227	26030	01037		
•	01221			MUL W(DMIN2CPLB)	01230	22C30	C1025		
•	01222			RJP LEFRNOOFF	01231	65000	01364		
•	01223			ADD A*W(KENNEOY)	01232	20030	C104C		
•	01224			ADD A*W(GAMMA)	01233	20030	01016		
•	01225			STR A*W(NUMEROIV)	01234	15030	C1041		
•	01226			ENT A*W(FBESSEL)*APOS	01235	11630	01042		
•	01227			JP MINUS	01236	61000	C1244		
•	01230			LSH A*1*ANEG	01237	C6700	C0001		
•	01231			ENT A*W(BESSEL)*SKIP	01240	11130	01027		
•	01232			RPL Y+1*W(BESSEL)	01241	36030	C1027		
•	01233		SUM	JP SUM	01242	20034	CC0CC		
•	01234			EXIT	01243	61010	C105C		
•	01235		M(NUS	LSH A*1*APOS	01244	C6600	C0001		
•	01236			ENT A*W(BESSEL)*SKIP	01245	11130	C1027		
•	01237			RPL Y-1*W(BESSEL)	01246	37030	C1027		
•	01240			JP CIVIL*QPOS	01247	61000	C1242		
•	01241		REMAINDER	STR A-A	0125C	60200	C1256		
•	01242			SUB A*3*APOS	01251	15040	CCCCC		
•	01243			JP LINCOLN	01252	21600	CCCC3		
•	01244			SUB Q*1	01253	61000	C1144		
•	01245			JP LINCOLN	01254	27000	CC0C1		
•	01246			SUB A*3*APOS	01255	61000	C1144		
•	01247		CIVIL		01256	21600	CCCC3		

MOONTRACK

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CARDS	L1 ID	LABEL	TA STATEMENT	LOC	F	JKB	Y	NOTES
• 01250			JP LINCOLN	01257	61000	C1144		
• 01251			ADD Q*1	01260	26000	CCOC1		
• 01252		FLOTEST1	JP LINCOLN	01261	61000	C1144		
• 01253			ENT A*W(FBESSEL)*ANEG	01262	11730	01042		
• 01254			ADD A*W(FBESSEL+2)*SKIP	01263	20130	01044		
• 01255			JP BOTHNEG1	01264	61000	C1274		
• 01256			JP NOFLO1*APOS	01265	60600	C120C		
• 01257			SEL CL*W(KEY)	01266	52030	01013		
• 01260			STR A*W(FBESSEL)	01267	15030	C1042		
• 01261			ENT Q*W(FBESSEL+2)	0127C	10030	C1031		
• 01262			ADD Q*1	01271	26000	00001		
• 01263			RPL Y+Q*W(FBESSEL)	01272	34030	C1027		
• 01264			JP FIX1+3	01273	61000	C1204		
• 01265		BOTHNEG1	ADD A*W(FBESSEL+2)	01274	20030	01044		
• 01266			JP NOFLO1*ANEG	01275	60700	C120C		
• 01267			SEL SET*W(KEY)	01276	50030	C1013		
• 01270			STR A*W(FBESSEL)	01277	15C30	C1042		
• 01271			ENT Q*W(FBESSEL+2)	01300	10030	C1031		
• 01272			SUB Q*1	01301	27C00	CCOC1		
• 01273			RPL Y+Q*W(FBESSEL)	01302	34030	C1027		
• 01274			JP FIX1+3	01303	61000	C1204		
• 01275		FLOTEST2	ENT A*W(FBESSEL)*ANEG	01304	11730	C1042		
• 01276			ADD A*W(FBESSEL+3)*SKIP	01305	20130	01045		
• 01277			JP BOTHNEG2	01306	61000	C1316		
• 01300			JP NOFLO2*APOS	01307	60600	C1206		
• 01301			SEL CL*W(KEY)	0131C	52C30	C1013		
• 01302			STR A*W(FBESSEL)	01311	15030	C1042		
• 01303			ENT Q*W(FBESSEL+3)	01312	10030	C1032		
• 01304			ADD Q*1	01313	26000	CCOC1		
• 01305			RPL Y+Q*W(FBESSEL)	01314	34030	C1027		
• 01306			JP FIX2+3	01315	61000	C1212		
• 01307		BOTHNEG2	ADD A*W(FBESSEL+3)	01316	20030	C1045		
• 01310			JP NOFLO2*ANEG	01317	60700	C1206		
• 01311			SEL SET*W(KEY)	01320	50030	C1013		
• 01312			STR A*W(FBESSEL)	01321	15030	C1042		
• 01313			ENT Q*W(FBESSEL+3)	01322	10030	C1032		
• 01314			SUB Q*1	01323	27000	CCOC1		
• 01315			RPL Y+Q*W(FBESSEL)	01324	34030	C1027		
• 01316			JP FIX2+3	01325	61000	C1212		
• 01317		FLOTEST3	ENT A*W(FBESSEL)*ANEG	01326	11730	C1042		
• 01320			ADD A*W(FBESSEL+4)*SKIP	01327	20130	01046		
• 01321			JP BOTHNEG3	01330	61000	C134C		
• 01322			JP NOFLO3*APOS	01331	60600	C1214		
• 01323			SEL CL*W(KEY)	01332	52C30	C1013		
• 01324			STR A*W(FBESSEL)	01333	15C30	C1042		
• 01325			ENT Q*W(FBESSEL+4)	01334	10030	C1033		
• 01326			ADD Q*1	01335	26000	CCOC1		
• 01327			RPL Y+Q*W(FBESSEL)	01336	34C30	C1C27		
• 01330			JP FIX3+3	01337	61000	C122C		
• 01331		BOTHNEG3	ADD A*W(FBESSEL+4)	01340	20030	C1046		

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MOONTRACK

CARDS	L1	ID	LABEL	TA STATEMENT	LUC	F	JKB	Y	NCTES
*	01332			JP NOFL03*ANEG	01341	60700	C1214		
•	01333			SEL SET*W(IKEY)	01342	50030	C1013		
•	01334			STR A*W(IFBE SSEL)	01343	15030	C1042		
•	01335			ENT Q*W(BESSEL+4)	01344	10030	C1C33		
•	01336			SUB Q*1	01345	27C00	CC001		
•	01337			RPL Y+Q*W(BESSEL)	01346	34030	C1027		
•	01340		NEGRESS1	JP FIX3+3	01347	61000	0122C		
•	01341			LSH AQ*290	0135C	C70CU	CC035		
•	01342			SEL SET*W(IKEY)	01351	50030	C1013		
•	01343			JP STOR1	01352	61000	0112C		
•	01344		NEGRESS2	LSH AQ*290	01353	C7000	CC035		
•	01345			SEL SET*W(IKEY)	01354	50C30	C1013		
•	01346			JP STOR2	01355	61000	01137		
•	01347		NEGRESS3	LSH AQ*290	01356	C7000	CC035		
•	01350			SEL SET*W(IKEY)	01357	50030	C1013		
•	01351			JP STOR3	01360	61000	C116C		
•	01352		NEGESS4	LSH AQ*290	01361	C7000	CC035		
•	01353			SEL SET*W(IKEY)	01362	50030	01013		
•	01354			JP STOR4	01363	61000	C1174		
•	01355		LFRNDOFF	ENTRY	01364	61000	CC00C		
•	01356			JP MIKE*ANEG	01365	60700	C1371		
•	01357			LSH AQ*B5*QPOS	01366	C7205	CC00C		
•	01360			ADD A*1	01367	20C00	CC001		
•	01361			EXIT	0137C	61010	01364		
•	01362		MIKE	LSH AQ*B5*QNEG	01371	C7305	CCCCC		
•	01363			SUB A*1	01372	21000	CC001		
•	01364			EXIT	01373	61C10	C1364		
•	01365		YRREMAIN	0	01374	C0000	CCCCC		
•	01366		WHOLEYEAR	0	01375	COCOO	CCCCC		
•	01367		JULLIANDAY	0	01376	C0000	CCCCC		
•	01370		IMPERIAL	0	01377	COCOO	CCCCC		
•	01371		TAPEBLOCK	0	0140C	COCOO	CCCCC		
•	01372		TAPESEARCH	0	01401	COCOO	CCCCC		
•	01373		KAAD	0	01402	C0000	CCCCC		
•	01374		OECAO	0	01403	C0000	CCCCC		
•	01375		OISTAD	0	01404	C0000	CCCCC		
•	01376		RADIFAU	0	01405	C0000	CCCCC		
•	01377		DECODIFAD	0	01406	C0000	CCCCC		
•	01400		DISTDIFAC	0	01407	C0000	CCCCC		
•	014C1		TIME2	0	0141C	COCOO	CCCCC		
•	014L2		SAFE	0	01414	C0000	CCCCC		
•	014U3		AEPHEM		01411	C0000	CCCCC		
•	014U4		LASTEPHEM	0	03611	C0000	CCCCC		
•	014U5		RESERVE	1	03612	C0000	CCCCC		
					03613	CC014	77775		
					03614	C0112	30264		
					03615	C0112	32001		
					03616	CC005			

SPURT OUTPUT NO. 211

FRACHITMAN# 7/14/64

MDONTRACK

LDC	LABEL	LDC	LABEL	LDC	LABEL	LOC
A\$5\$5\$1111	03613	A\$5\$5\$1112	03614	03615	\$\$\$\$\$1113	63075
A\$5\$5\$1114	03616	ACQAZIM	63071	63075	ACQELEV	
ACQUI	63427	ACTUALTIME	63142	63146	ADSCN	
AEPHEM	01412	AESCN	63417	63416	AIRPCRT	
ALBERT	00462	ASTRDEEC	63106	0D230	ASTRDRDRA	
AUCDNVFR	63332	AZIM	63053	63105	AZIMDUT	
AZIMOVER	63325	AZIMADD	63442	64000	AZIMIN	
BOTHNEG1	01274	BOTHNEG2	01316	75000	BOTHNEG3	
BARRIER	00473	BEAVER	00264	01340	BESSEL	
BETA	01015	BLASTOFF	63146	01D27	BUST	
COCON	63414	CONVERTIME	63135	00476	CCRCT	
COSORIENT	63065	COSAZEL	6307C	6342D	CANTFIND	
CALIM	63060	CELCOMPGM	63424	01342	CELEV	
CELLTIME	63133	CERO	00337	63D57	CHCDR	
CHPAR	63431	CIVIL	01256	CRANGE	DATANALYZE	
DOPPUT	66000	DPUPADU	63444	63425	DAYINCRMNT	
DAY	63150	DAYFIND	00323	00351	DECDDT	
DEC	63003	DECAD	01403	63010	DELTA	
DECDFAD	01406	DELTIA	01017	63316	DEL TATEE	
DISTAD	01404	DISTIFAD	01407	00632	DLN	
DLN1	00650	DLN2	00654	00655	DLN3	
DLN4	00657	DLN5	00660	00662	DLN6	
DLN7	00663	DMIN2CP1B	01025	01024	DMINB	
DSECDNDS	63141	DUMSECTTG	63154	63421	DYCMP	
ELEV	63054	ELEV VOUT	6500C	63443	ELEVACC	
ELEVIN	76000	ENDFILE	00472	01026	EP2BM2CM4	
EPHEMA	00532	EPHEMB	00533	00534	EPHEMC	
EPHEMD	00535	EPHEME	00536	00537	EPHEMF	
EPSILON	01020	EQUATOR	63323	00011	ERASE	
ERNMSEC	00777	EST SHIFTED	63143	63335D	EXPNAME	
FBESELL	01042	FIRSTDIFF	01014	63104	FIRSTELEV	
FIRSTTHRU	63153	FIX1	01201	01207	FIX2	
FIX3	01215	FLUIEST1	01262	01304	FLOTFS2	
FLOTTEST3	01326	FLATNEG	00305	63101	FRAMESIZE	
FREQUENCY	63317	FUNCTION	01021	01016	GAMMA	
GEDCENLAT	63322	GEODETLAT	63321	00665	GMT	
GMT1	00703	GMT2	00707	00710	GMT3	
GMT4	00712	GMT5	00713	00715	GMT6	
GMT7	00716	GMTMDDU24	63145	63144	GMTSHIFTED	
HDUR	00766	HOURMINUTE	63137	63151	HURREG	
HALF	01023	HALFDAY	0076C	00235	HARVARD	
HDAY	00772	HEIGHT	63326	00000	HENRY	
HRAD	00770	ID10RAD10	66777	67776	ID11RAD1C	
ID12RADIO	67777	ID13RAD1D	70775	70776	ID14RAD1C	
ID15RAD10	71776	ID16RAD1D	71777	72776	ID17RAD1C	
ID18RAD10	72777	ID19RAD1D	73776	63D00	ID16CELCOR	
ID1ENTPNT	63410	ID1RADCDR	6305C	6344D	ID1RAC10	
ID1RECRD	63210	ID1SYSENT	77576	77676	ID1SYSNAM	
ID1SYSPAR	63310	ID1TIME	6313C	73777	ID2CRADIC	
ID21RADIO	74776	ID22RAD10	74777	75776	ID23RAC1C	
ID24RAD10	75777	ID25RAD10	76775	76776	ID26RAC1C	

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MOONTRACK	LOC	LABEL	LOC	LABEL	LOC	LABEL	LOC	LDC
ID2CELCOR	63001	I02ENTPNT	63411	ID2RADCOR	63051			
ID2RADIO	63441	I02RECRD	63211	ID2SYSENT	77577			
ID2SYSNAM	77677	I02SYSPAR	63311	ID2TIME	63131			
ID3RADIO	63776	I04RADIO	63777	ID5RADIO	64776			
ID6RADIO	64777	I07RADIO	65776	ID8RADIO	65777			
ID9RADIO	66776	IGNORE	00763	IMPERIAL	01377			
INAZIMADD	63446	INELEVADD	63447	INITIAL1	00557			
INITIAL10	00570	INITIAL11	00574	INITIAL12	00576			
INITIAL16	00722	INITIAL17	00726	INITIAL18	00730			
INITIAL19	00733	INITIAL2	00563	INITIAL2C	00737			
INITIAL21	00741	INITIAL3	00565	INITIALRC	00731			
INITIALDAT	00566	INITIALDIS	00720	INITIALJC	00555			
INTER	63413	INTERAZIM	7200C	INTERCOM	63426			
INTERDUPP	7400D	INTERELEV	7300C	INTERPCL	01050			
INTERRANGE	76777	INTERRUPT	00764	JULIANDAY	01376			
KENNEDY	01040	KEY	01013	LONGITUDE	63320			
LASTEPHEM	03611	LEFRNDOFF	01364	LESSNE	00321			
LINCOLN	01144	LUNAR	0010D	MDDNCNT	00232			
MOONINIT	00002	MODNTIME	00352	MCSE	00245			
MONITAPE	00055	MONTHPRINT	00743	MAINSWITCH	63334			
MCPFILLER	7100U	MCPGM	63412	MDAY	00773			
MIKE	01371	MINREG	63152	MINSRAD	00771			
MINUS	01244	NODATA	00540	NCDATA1	00542			
NODATA2	00546	NODATA3	00552	NCFLC1	01200			
NOFLQ2	01206	NOFL03	01214	NDRML	00102			
NEGNESS1	01350	NEGNESS2	01353	NEGNESS3	01356			
NEGNESS4	01361	NEGDEC	00527	NEGTIME	00406			
NUMBERIV	01041	P	01022	POLE	63324			
PLANP	63434	PRINT	00212	PRLCG	63423			
PSQMP	01034	PSQMP6	01035	RA	63002			
RA1	00615	RA2	00621	RA3	00622			
RA4	00624	RA5	00625	RA6	00627			
RA7	00630	RAAD	01402	RADAT	63007			
RADARMOOE	63312	RADIOMETER	63102	RADIFAC	01405			
RADIUS	63DU6	RADIUSDT	63011	RANGE	63052			
RANGEOUT	70777	RANGEADD	63445	RANGEDDJ	63062			
RDMTR	63430	RDXXX	63433	RECAZIM	67000			
RECELEV	70000	RECFILE	63212	RECRE	63415			
REMAINDER	01250	REVSRAIAN	00761	REWINDO	00765			
RGHTASC	00577	RHRSEC	0100D	SAFE	01411			
SARAD	00776	SALIM	63D55	SCETIME	63134			
SAY	00774	SDEC	63D05	SEAPCRT	00304			
SECDNU5	63140	SECRAO	00775	SELEV	63056			
SETINTAD	01047	SIDERTIME	63D12	SINCRIENT	63064			
SINAZEL	63066	SIXTH	01037	SKIP	63331			
SRA	63004	SRAD	00767	SRACTIME	63136			
SRHIBIN	00762	STOR1	0112C	STCR2	01137			
STUR3	0116U	STDR4	01174	STCRE	00340			
STATACT	00422	STATUSCK	0D411	SUM	01242			
SYSENTRIES	77600	SYNAME	7770C	SYSTAT1	63313			
SYSTAT2	633314	SYSTATD	63315	TAPEBLCK	01400			

SPURT OUTPUT NO. 211		FRACHTMAN•7/14/64	
MOONTRACK	LOC	LABEL	LOC
TAPEBUST	00515	TAPEBUST1	00517
TAPESEARCH	01401	TAPSTAT	00524
TIME2	01410	TIMEMODE	63103
TRUE RANGE	63063	TRUE TIME	63132
TWOLESS	00317	TWOPIE	01001
VIZDEC2	63016	VIZRA1	63013
WORLDFAIR	00357	WFORD	63432
WFFREQ	63333	WHOLEYEAR	01375
YEARPRINT	01002	YRREMAIN	01374
ZRTRAN	63330		

LABEL	LOC	LABEL	LOC
TAPEINPUT	00035		
THIRD	01036		
TIMEP	63435		
TRYAGAIN	00034		
VIZDEC1	63014		
VIZRA2	63015		
WFACD	63450		
YEARMONTH	63147		
YRTRAN	63327		

SPURT OUTPUT NO. 212

FRACHTMAN#7/14/64

MOUNTTRACK	LOC	LABEL	LOC	LABEL	LOC	LABEL	LOC	LABEL
HENRY	00000	MODNINIT	000002	ERASE	000011			
TRYAGAIN	00034	TAPEINPUT	000035	MONITAPE	000055			
LUNAR	00100	NORMAL	00102	PRINT	00212			
AIRPORT	00230	MOONCONT	00232	HARVARD	00235			
MOUSE	00245	BEAVER	00264	SEAPCRT	00304			
FLATNEG	00305	TWOLESS	00317	LESSONE	00321			
DAYFIND	00323	CERO	00337	STDR	00340			
DAYINCMMI	00351	MOONTIME	00352	WORLDFAIR	00357			
NEGTIME	00406	STATUSCK	00411	STATACT	00422			
CANTFIND	00442	ALBERT	00462	ENDFILE	00472			
BARRIER	00473	BUST	00476	TAPEBUST	00515			
TAPEBUST1	00517	TAPSTAT	00524	NEGDEC	00527			
EPHEM	00532	EPHEMB	00533	EPHEMC	00534			
EPHEMD	00535	EPHEME	00536	EPHEMF	00537			
NODATA	00540	NODATA1	00542	NODATA2	00546			
NODATA3	00552	INITIALJO	00555	INITIAL1	00557			
INITIAL2	00563	INITIAL3	00565	INITIALCAT	00566			
INITIAL10	00570	INITIAL11	00574	INITIAL12	00576			
RGHTASC	00577	RA1	00615	RA2	00621			
RA3	00622	RA4	00624	RA5	00625			
RA6	00627	RA7	00630	DLN	00632			
DLN1	00650	DLN2	00654	DLN3	00655			
DLN4	00657	DLN5	00660	DLN6	00662			
DLN7	00663	GMT	00665	GMT1	00703			
GMT2	00707	GMT3	00710	GMT4	00712			
GMT5	00713	GMT6	00715	GMT7	00716			
INITIALDIS	00720	INITIAL16	00722	INITIAL17	00726			
INITIAL18	00730	INITIAL800	00731	INITIAL19	00733			
INITIAL20	00737	INITIAL21	00741	MCNTHPRINT	00743			
HALFDAY	00760	REVRADIAN	00761	SRHIBIN	00762			
IGNORE	00763	INTERRUPT	00764	REWINDNO	00765			
HOUR	00766	SRAD	00767	HRAC	00770			
MINSRAD	00771	HOAY	00772	MDAY	00773			
SDAY	00774	SECRAD	00775	SARAD	00776			
ERNMSEC	00777	RHRSEC	01000	TWCPIE	01001			
YEARPRINT	01002	KEY	01013	FIRSTCIEFF	01014			
BETA	01015	GAMMA	01016	DELTA	01017			
EPSILON	01020	FUNCTION	01021	P	01022			
HALF	01023	DMINB	01024	DMIN2CPBL	01025			
EP28M2DMA	01026	BESSEL	01027	PSCMP	01034			
PSQMP6	01035	THIRD	01036	SIXTH	01037			
KENNEDY	01040	NUMDERIV	01041	F8ESSEL	01042			
SETINIAID	01047	INTERPOL	01050	STDRL	01120			
STOR2	01137	LINCOLN	01144	STCR3	01160			
STOR4	01174	NOFL01	01200	FIX1	01201			
NOFL02	01206	FIX2	01207	NCFLC3	01214			
FIX3	01215	SUM	01242	MINOS	01244			
REMAINDER	01250	CIVIL	01256	FLCIEST1	01262			
ROTHNEG1	01274	FLOWEST2	01304	BCTHNEG2	01316			
FLOWEST3	01326	ROTHNEG3	01340	NEGNESS1	01350			
NEGNESS2	01353	NEGNESS3	01356	NEGNESS4	01361			

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MOUNTTRACK

FRACHTMAN#7/14/64

LOC	LOC	LOC	LOC	LOC	LOC	LOC	LOC	LOC	LOC
LEFRNUFF	01364	MIKE	01371	YRREMAIN	01374				
WHOLEYEAR	01375	JULIANDAY	01376	IMPERIAL	01377				
TAPEBLOCK	01400	TAPESEARCH	01401	RAAD	01402				
DECAD	01403	DISTAD	01404	RADIIFAD	01405				
DECDFAD	01406	DISTDIFAD	01407	TIME2	01410				
SAFE	01411	AEPHEM	01412	LASTEPHM	03611				
ASSSSSS1111	03613	A\$\$\$\$\$1112	03614	ASSSS1113	03615				
ASSSSSS1114	03616	IDICELCOR	03600	ID2CELCDR	63001				
RA	63002	DEC	63003	SRA	63004				
SDEC	63005	RADIUS	63006	RADOT	63007				
DECDDT	63010	RADIUSDOT	63011	SIDERTIME	63012				
VIZRA1	63013	VIZDECI	63014	VIZRAZ	63015				
VIZDEC2	63016	IDIRADCOR	63050	ID2RADCDR	63051				
RANGE	63052	AZIM	63053	ELEV	63054				
SAZIM	63055	SELEV	63056	CRANGE	63057				
CAZIM	63060	CELEV	63061	RANGEDDT	63062				
TRUERANGE	63063	SINORIENT	63064	CCSRIENT	63065				
SINAZEL	63066	COSAZEL	63070	ACQAZIM	63071				
ACQELEV	63075	FRAMESIZE	63101	RADIOMETTER	63102				
TIMEMODE	63103	FIRSTELEV	63104	ASTRCRA	63105				
ASTRODEC	63106	ID1TIME	63130	ID2TIME	63131				
TRUE TIME	63132	CELTIME	63133	SCLTIME	63134				
CONVERT TIME	63135	SRADTIME	63136	HOURMINUTE	63137				
SECONDS	63140	DSECONDS	63141	ACTUALTIME	63142				
ESTSHIFTED	63143	GMTSHIFTED	63144	GTMCDU24	63145				
BLASTOFF	63146	YEARMONTH	63147	DAY	63150				
HOURREG	63151	MINREG	63152	FIRSTTHRU	63153				
DUMSECTTG	63154	ID1RECORD	6321C	ID2RECRD	63211				
RECFILE	63212	ID1SYSPAR	6331C	ID2SYSPAR	63311				
RADARMDE	63312	SYSTAT1	63313	SYSTAT2	63314				
SYSTAD	63315	DELDATE	63316	FREQUENCY	63317				
LONGITUDE	63320	GEODETLAT	63321	GEDCENLA	63322				
EQUATOR	63323	POLE	63324	AZIMGYVER	63325				
HEIGHT	63326	YRTRAN	63327	ZRTRAN	63330				
SKIP	63331	AUDNVER	63332	WFFREQ	63333				
MAINSWITCH	63334	EXPNAME	6335C	ID1ENTPNT	6341D				
ID2ENTPNT	63411	MCPGM	63412	INTER	63413				
COCON	63414	RECORD	63415	ADSCN	63416				
AESCN	63417	CORT	63420	DYOMP	63421				
CHCDR	63422	PROLOG	63423	CELCCMPGK	63424				
DATAANALYZE	63425	INTERCDM	63426	ACQUI	63427				
RDCTR	63430	CHPAR	63431	WFDR	63432				
RDXX	63433	PLANP	63434	TIMEP	63435				
ID1RADIO	63440	ID2RADIO	63441	AZIMADD	63442				
ELEVADD	63443	DOPPADD	63444	RANGEADD	63445				
INAZIMADD	63446	INELEVADD	63447	WFACC	63450				
ID3RADIO	63776	ID4RADIO	63777	AZIMCUT	64000				
ID5RADIO	64776	ID6RADIO	64777	ELEVUT	65000				
ID7RADIO	65776	ID8RADIO	65777	OPPDUT	66000				
ID9RADIO	66776	ID10RADIO	66777	RECAZIM	67000				
ID11RADIO	67776	ID12RADIO	67777	RECELEV	7CDOD				

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MOONTRACK	LOC	LABEL	LCC
ID13RADIO	70775	I014RADIO	70776
MCPFILLER	71000	I015RADIO	71776
INTERAZIM	72000	I017RADIO	72776
INTERELIEV	73000	I019RADIO	73776
INTERUOPP	74000	I021RADIO	74776
AZIMIN	75000	I023RADIO	75776
ELLVIN	76000	I025RADIO	76775
INTERANGE	76777	I01SYSENT	77576
SYSENTRIES	77600	I01SYSNAM	77676
SYSNAMES	77700		

LABEL	LOC	LABEL	LCC	LABEL	LDC
ID13RADIO	70775	I014RADIO	70776	RANGECLT	70777
MCPFILLER	71000	I015RADIO	71776	ID16RACIC	71777
INTERAZIM	72000	I017RADIO	72776	ID18RACIC	72777
INTERELIEV	73000	I019RADIO	73776	ID2CRADIC	73777
INTERUOPP	74000	I021RADIO	74776	ID22RADIC	74777
AZIMIN	75000	I023RADIO	75776	ID24RACIC	75777
ELLVIN	76000	I025RADIO	76775	ID26RACIC	76776
INTERANGE	76777	I01SYSENT	77576	ID2SYSENT	77577
SYSENTRIES	77600	I01SYSNAM	77676	ID2SYSNAM	77677
SYSNAMES	77700				

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3. R. Butler and E. Kerr, An Introduction to Numerical Methods (Sir Isaac Pitman and Sons, Ltd., London).

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Moontrack
Program Inputs
Program Outputs
Astronomical Significance

LINK A		LINK B		LINK C	
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